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INSTRUMENTATION REPORT - DARLINGTON GS TURBO-GENERATOR UNIT 3 STABILITY INSTRUMENTATION REPORT

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This report describes the instrumentation and reading technique used in the Unit 3 turbo-generator settlement monitoring program at Darlington GS. Similar installations have been successfully completed on Units 1 and 2. Unit 3 contains less instrumentation than Units 1 and 2. The datum readings for Unit 3 are presented in this report. An addendum will be prepared as the readings are obtained during machine erection and commissioning.

INTRODUCTION

Four single shaft 850 MW turbo-generators are being installed at Darlington GS. Due to the size and complexity of the turbo-generator foundations, it was considered that information on their stability performance should be obtained. Units 1 and 2 were completely instrumented as described in/1/.

A lesser amount of instrumentation was planned for Unit 3, consisting of 12 combination stations on the turbine table (elevation 115.0 m) for horizontal alignment, vertical settlement and dynamic velocity measurements. Installation of these instruments and initial readings in the table in an unloaded condition are presented.

TURBINE TABLE SETTLEMENT STATIONS

Twelve multi-purpose stations are located on top of the turbo-generator support table at elevation 115.0 m (operating floor). Figure 1 shows how these stations are constructed and the location of these stations is shown in Figure 2.

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(a) The purpose of these stations is to measure differential movements of the machine floor in both the vertical and horizontal directions as well as provide a reference point for monitoring vibration levels of the structure. The specially designed reference stations were installed opposite the centreline of each bearing of the machine in two straight lines, one on each side of the turbo-generator. Each station is provided with a protective cover. See Figure 1 for an illustration of these stations.

(b) The elevation of each of the twelve reference stations is obtained to an accuracy of 0.1 mm (0.004 in). The 2.0 meter invar levelling rod, with a flat seat, is held on the rounded top of the reference station. Using the Wild-N3 precise level and standard procedures for precision levelling, measurements on the complete traverse of 12 reference stations are made. An accuracy of +/- 0.15 mm for any station relative to the datum station, under favourable working conditions, is achievable. Any vibration or heat produced when the unit is running decreases this accuracy. The initial datum readings are tabulated in Table I. These elevation readings are given relative to table station T-1A, located in the southwest corner of the table (see Figure 2).

TURBINE TABLE ALIGNMENT STATIONS

The same twelve reference stations described above are used to take the alignment measurements. For location of these stations, see Figure 2.

(a) The purpose of these measurements is to determine the horizontal displacements of the machine floor relative to an optical line of sight. A Wild T-2 theodolite and targets with optical plumbs were used to measure small horizontal displacements (offsets) of the alignment stations from an optical line of sight. The line of sight is referenced to the stations at each end of the turbine table.

(b) The following procedure is used to take the measurements. The T-2 is placed centrally by optical plumbing on the alignment target cemented on the designated area of the reference station at one end of the unit (see Figure 1). A fixed target is similarly placed over the alignment target on the reference station at the other end of the unit, establishing an optical line of sight. Once the instruments are plumbed over their reference stations they are not moved during the series of measurements. A movable target, which carried a modified precision vernier caliper scale (for adjusting the target at right angles to the line of sight), is similarly set up over each of the four "in between" stations and their offset measurements are taken. With extreme care in setting the targets and adjusting the plane of the scale at right angles to the line of sight, the horizontal displacements (offset), to the left or right of the line of sight, can be measured to an estimated accuracy of +/- 0.25 mm. Repeatability error due to the setting up of the instruments relative to the reference target introduces an estimated additional +/- 0.25 mm into the reading accuracy of each measurement. Any heat or vibration produced when the unit is running decreases this accuracy. The movable target vernier is calibrated in inches. These alignment

readings are taken on both sides of the turbine table. (Initial datum readings are presented in Table II.)

SUMMARY

The instrumentation program for Unit 3 have been tailored to obtain the vertical and horizontal movement in the machine table.

The initial datum readings for Unit 3 has been taken and are recorded in this report. An addendum will report any subsequent readings when they are taken.

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REFERENCES

1. Fraser, D.S. "Installation Report - Darlington GS Turbo-generators Units 1 and 2 Stability Instrumentation". Research Division Report No 87-175-K, August 1987.

TABLE I

Differential Vertical Elevations
Darlington GS Unit 3
Elevation 115.0 m (Machine Table Stations)

Datum Readings (Bare Table)
Date: October 24, 1988

Station	Elevation (mm) (Relative to Station T-1A)
T-1	11.75
T-1A	0.00
T-2	-3.00
T-2A	4.35
T-3	-6.40
T-3A	-2.35
T-4	-2.60
T-4A	-1.85
T-5	12.70
T-5A	8.85
T-6	1.60
T-6A	0.95

TABLE II

Differential Horizontal Movements
Turbo-Generator Foundation
Darlington GS Unit No 3

Datum Readings (Bare Table)
Date: October 25, 1988

Station	Side	Average Reading (mm)
T-1	North	Theodolite Station
T-2		78.740
T-3		75.311
T-4		79.934
T-5		84.506
T-6		TARGET
T-1A	South	Theodolite Station
T-2A		89.611
T-3A		53.950
T-4A		76.683
T-5A		79.223
T-6A		TARGET

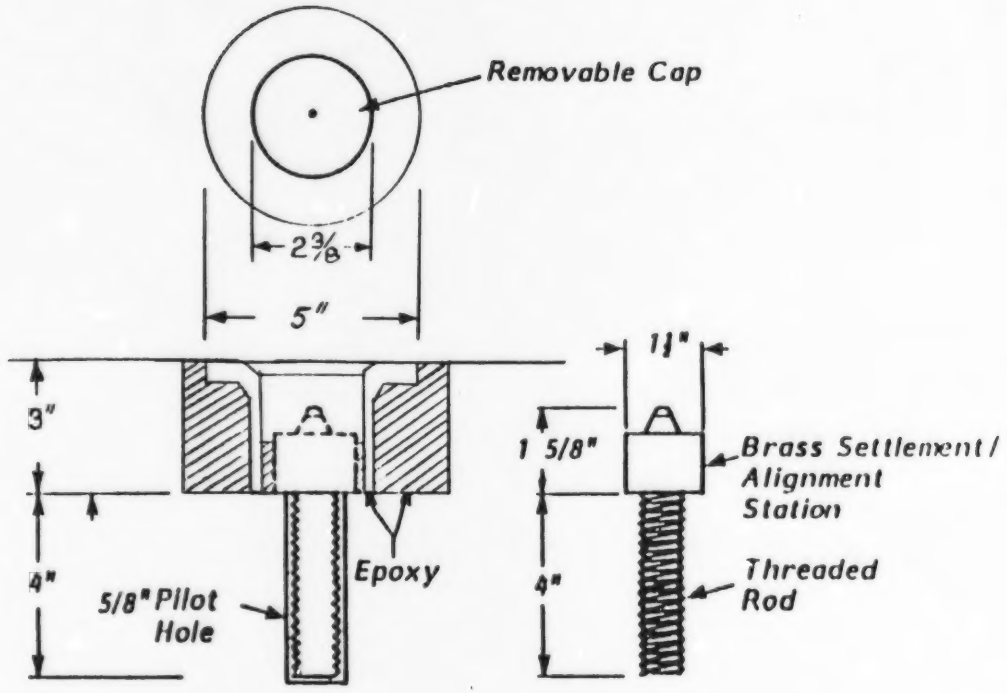

FIGURE 1

SETTLEMENT/ALIGNMENT STATIONS

(revised 08-88)

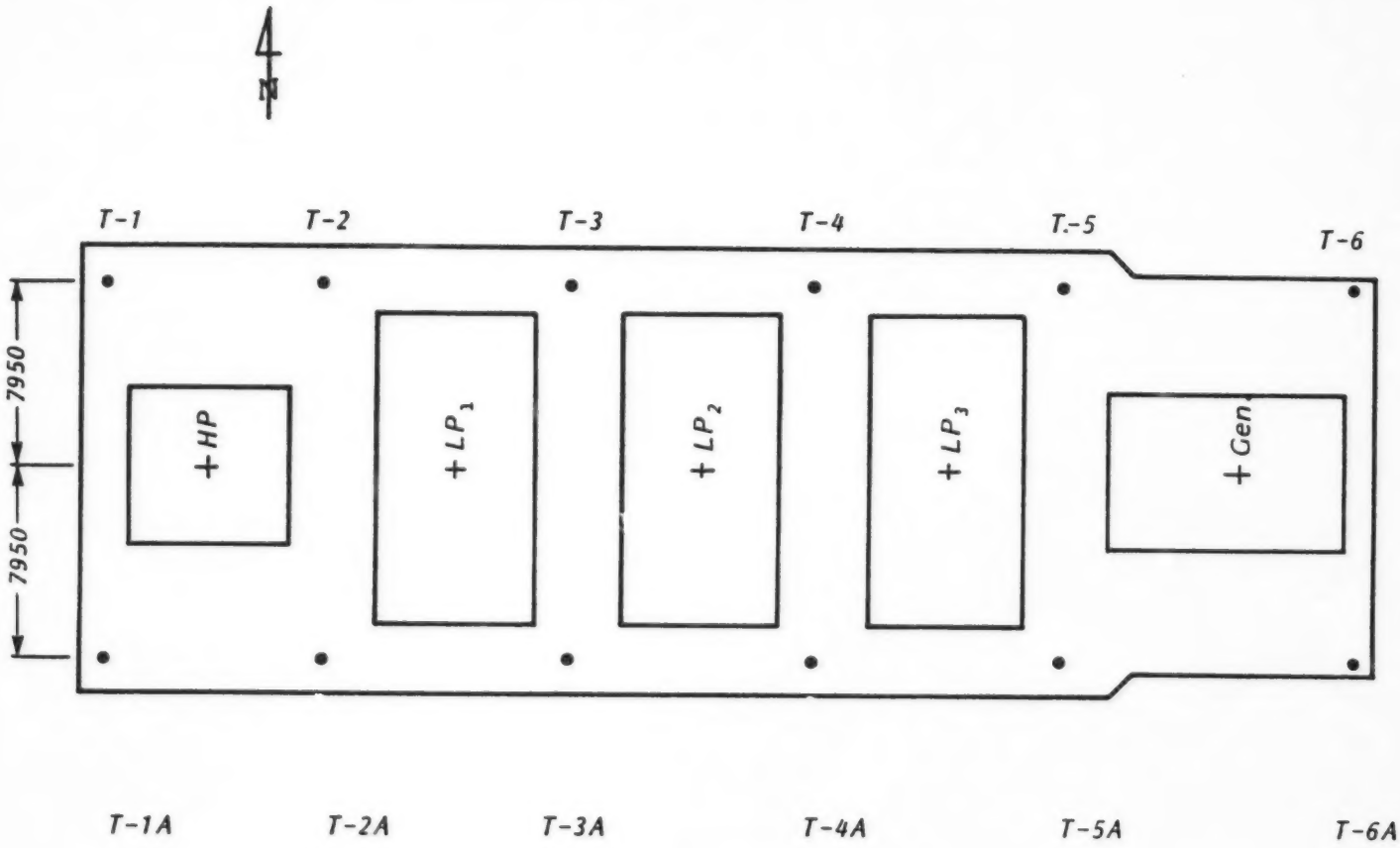

FIGURE 2

DARLINGTON GS UNIT 3
ELEVATION/ALIGNMENT STATIONS - 115 ELEV